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(71)Applicant : MATSUSHITA ELECTRIC IND CO
LTD

(22)Date of filing : 02. 10. 2002 (72)Inventor : KONDO TOSHIYUKI
SUMINO SHINYA
HAGAI MAKOTO
ABE SEISHI

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(54) VARIABLE LENGTH ENCODING METHOD AND VARIABLE LENGTH DECODING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To improve an encoding efficiency of a variable length encoding when an image is divided into different-sized blocks and encoded.

SOLUTION: Number of coefficient of a periphery block is referred and a variable length encoding table is switched at a code row forming portion 104 when the number of the coefficient of an encoding objected block is encoded. When the sizes of the encoding objected block and the periphery block are different the number of the coefficient of the periphery block is converted so as to accord the size of the encoding objected block to the size of the periphery block.

CLAIMS

[Claim(s)]

[Claim 1]

It is the variable-length-coding method used when dividing a picture into two

or more blocks and coding by making said block into a unit

A variable-length-coding table used when coding information on a coding target block
A variable-length-coding method using information on said peripheral blocks for a size of said coding target block changing it when it determines according to information on peripheral blocks of said coding target block and sizes of said coding target block and said peripheral blocks differ.

[Claim 2]

A variable-length-coding method according to claim 1 wherein said information is the number of a significant coefficient of a block.

[Claim 3]

It is the variable-length-coding method used when dividing a picture into two or more blocks and coding by making said block into a unit

A probability table used when coding information on a coding target block
A variable-length-coding method using information on said peripheral blocks for a size of said coding target block changing it when it determines according to information on peripheral blocks of said coding target block and sizes of said coding target block and said peripheral blocks differ.

[Claim 4]

A variable-length-coding method according to claim 3 wherein said information is information which shows whether a block has a significant coefficient.

[Claim 5]

It is the variable-length-coding method used when dividing a picture into two or more blocks and coding by making said block into a unit

A variable-length-coding method using different probability tables according to a size of a coding target block when coding a coefficient value of a coding target block.

[Claim 6]

It is the variable-length-coding method used when dividing a picture into two or more blocks and coding by making said block into a unit

A variable-length-coding method using the same probability table regardless of a size of a coding target block when coding a coefficient value of a coding target block.

[Claim 7]

It is a variable length decoding method used when dividing a picture into two or more blocks and decrypting by making said block into a unit

A variable-length decryption table used when decrypting information on a decryption object block
A variable length decoding method using information on said peripheral blocks for a size of said decryption object block changing it when it determines according to information on peripheral blocks of said decryption object block and sizes of said decryption object block and said peripheral blocks differ.

[Claim 8]

The variable length decoding method according to claim 7 wherein said information is the number of a significant coefficient of a block.

[Claim 9]

It is a variable length decoding method used when dividing a picture into two or more blocks and decrypting by making said block into a unit

A probability table used when decrypting information on a decryption object block
A variable length decoding method using information on said peripheral blocks for a size of said decryption object block changing it when it determines according to information on peripheral blocks of said decryption object block and sizes of said decryption object block and said peripheral blocks differ.

[Claim 10]

The variable length decoding method according to claim 9 wherein said information is information which shows whether a block has a significant coefficient.

[Claim 11]

It is a variable length decoding method used when dividing a picture into two or more blocks and decrypting by making said block into a unit

A variable length decoding method using different probability tables according to a size of a decryption object block when decrypting a coefficient value of a decryption object block.

[Claim 12]

It is a variable length decoding method used when dividing a picture into two or more blocks and decrypting by making said block into a unit

A variable length decoding method using the same probability table regardless of a size of a decryption object block when decrypting a coefficient value of a decryption object block.

[Claim 13]

It is the variable-length-coding method used when dividing a picture into two or more blocks and coding by making said block into a unit

A variable-length-coding table used when coding information on a coding target block
When coding structures whether said coding target block and said peripheral blocks are coded by the frame structure by determining according to information on peripheral blocks of said coding target block or to be coded by field structure differ
Said variable-length-coding table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks.

A variable-length-coding method characterized by things.

[Claim 14]

By a case where coding structures whether said coding target block and said

peripheral blocks are coded by the frame structure or to be coded by field structure differ. And when said variable-length-coding table cannot be determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks said predetermined variable-length-coding table is used.

A variable-length-coding method according to claim 13 characterized by things.
[Claim 15]

Said information is the number of a significant coefficient of a block.

A variable-length-coding method according to claim 13 characterized by things.
[Claim 16]

When coding structures of said coding target block and said peripheral blocks differsaid variable-length-coding table is determined according to information acquired by equalizing information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks.

A variable-length-coding method according to claim 13 characterized by things.
[Claim 17]

When coding structures of said coding target block and said peripheral blocks differinformation on said peripheral blocks is repealed and said variable-length-coding table is determined according to other information.

A variable-length-coding method according to claim 13 characterized by things.
[Claim 18]

The 1st peripheral blocks located leftward [of said coding target block] are contained in said peripheral blocks

When coding structures of said coding target block and said 1st peripheral blocks differSaid variable-length-coding table is determined according to information acquired by equalizing information on the 2nd peripheral blocks corresponding to said 1st peripheral blocks and information on said 1st peripheral blocks or information on said peripheral blocks is repealed and said variable-length-coding table is determined according to other information.

A variable-length-coding method according to claim 13 characterized by things.
[Claim 19]

The 3rd peripheral blocks located in above [of said coding target block] are contained in said peripheral blocks

When said coding target block is coded by the frame structure and said 3rd peripheral blocks are coded by field structureSaid variable-length-coding table is determined according to information acquired by equalizing information on the 4th peripheral blocks corresponding to said 3rd peripheral blocks and information on said 3rd peripheral blocks or information on said 3rd peripheral blocks is repealed and said variable-length-coding table is determined according to other information.

A variable-length-coding method according to claim 13 characterized by things.

[Claim 20]

The 3rd peripheral blocks located in above [of said coding target block] are contained in said peripheral blocks

When said coding target block is coded by field structure and said 3rd peripheral blocks are coded by field structure said variable-length-coding table is determined according to information on the 4th peripheral blocks corresponding to said 3 peripheral blocks.

A variable-length-coding method according to claim 13 characterized by things.

[Claim 21]

The 3rd peripheral blocks located in above [of said coding target block] are contained in said peripheral blocks

When said coding target block is coded by field structure and said 3rd peripheral blocks are coded by the frame structure. [whether said variable-length-coding table is determined according to information on said 3rd peripheral blocks and] Said variable-length-coding table is determined according to information acquired by equalizing information on the 4th peripheral blocks corresponding to said 3rd peripheral blocks and information on said 3rd peripheral blocks or information on said 3rd peripheral blocks is repealed and said variable-length-coding table is determined according to other information.

A variable-length-coding method according to claim 13 characterized by things.

[Claim 22]

The 1st peripheral blocks located leftward [of said coding target block] and the 2nd peripheral blocks located in above [of said coding target block] are contained in said peripheral blocks

Said variable-length-coding table is determined according to information acquired by equalizing information on said 1st peripheral blocks and information on said 2nd peripheral blocks.

A variable-length-coding method according to claim 13 characterized by things.

[Claim 23]

When either information on said 1st peripheral blocks and information on said 2nd peripheral blocks are invalid said variable-length-coding table is determined according to information on a way which is not invalid

When information on said 1st peripheral blocks and information on said 2nd peripheral blocks are invalid it is decided that it will be the variable-length-coding table decided beforehand.

A variable-length-coding method according to claim 13 characterized by things.

[Claim 24]

It is the variable-length-coding method used when dividing a picture into two or more blocks and coding by making said block into a unit

A probability table used when coding information on a coding target block When

coding structures whether said coding target block and said peripheral blocks are coded by the frame structure by determining according to information on peripheral blocks of said coding target block or to be coded by field structure differ. Said probability table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks.

A variable-length-coding method characterized by things.

[Claim 25]

By a case where coding structures whether said coding target block and said peripheral blocks are coded by the frame structure or to be coded by field structure differ. And when said probability table cannot be determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks, said predetermined probability table is used.

A variable-length-coding method according to claim 24 characterized by things.

[Claim 26]

Said information is information which shows whether a block has a significant coefficient.

A variable-length-coding method according to claim 24 characterized by things.

[Claim 27]

When coding structures of said coding target block and said peripheral blocks differ, said probability table is determined according to information acquired by inputting information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks into the 1st function.

A variable-length-coding method according to claim 24 characterized by things.

[Claim 28]

When coding structure of said coding target block and said peripheral blocks is different, information on said peripheral blocks is repeated and said probability table is determined according to other information.

A variable-length-coding method according to claim 24 characterized by things.

[Claim 29]

The 1st peripheral blocks located leftward [of said coding target block] are contained in said peripheral blocks

When coding structures of said coding target block and said 1st peripheral blocks differ, said probability table is determined according to information acquired by inputting information on the 2nd peripheral blocks corresponding to said 1st peripheral blocks and information on said 1st peripheral blocks into the 1st function, or information on said peripheral blocks is made into a predetermined value and said probability table is determined according to the predetermined value.

A variable-length-coding method according to claim 24 characterized by things.
[Claim 30]

The 3rd peripheral blocks located in above [of said coding target block] are contained in said peripheral blocks

When said coding target block is coded by the frame structure and said 3rd peripheral blocks are coded by field structure Said probability table is determined according to information acquired by inputting information on the 4th peripheral blocks corresponding to said 3rd peripheral blocks and information on said 3rd peripheral blocks into the 1st function or information on said 3rd peripheral blocks is made into a predetermined value and said probability table is determined according to the predetermined value.

A variable-length-coding method according to claim 24 characterized by things.
[Claim 31]

The 3rd peripheral blocks located in above [of said coding target block] are contained in said peripheral blocks

When said coding target block is coded by field structure and said 3rd peripheral blocks are coded by field structure said probability table is determined according to information on the 4th peripheral blocks corresponding to said 3rd peripheral blocks.

A variable-length-coding method according to claim 24 characterized by things.
[Claim 32]

The 3rd peripheral blocks located in above [of said coding target block] are contained in said peripheral blocks

When said coding target block is coded by field structure and said 3rd peripheral blocks are coded by the frame structure. [whether said probability table is determined according to information on said 3rd peripheral blocks and] Said probability table is determined according to information acquired by inputting information on the 4th peripheral blocks corresponding to said 3rd peripheral blocks and information on said 3rd peripheral blocks into the 1st function or information on said 3rd peripheral blocks is made into a predetermined value and said probability table is determined according to the predetermined value.

A variable-length-coding method according to claim 24 characterized by things.
[Claim 33]

The 1st peripheral blocks located leftward [of said coding target block] and the 2nd peripheral blocks located in above [of said coding target block] are contained in said peripheral blocks

Said probability table is determined according to information acquired by inputting information on said 1st peripheral blocks and information on said 2nd peripheral blocks into the 2nd function.

A variable-length-coding method according to claim 24 characterized by things.

[Claim 34]

Said 1st function is either of the addition which carried out weighting to addition of a value which two information shows logical sum and logical product and one information.

A variable-length-coding method according to claim 30 or 32 characterized by things.

[Claim 35]

Said 2nd function is either addition of a value which two information shows addition which carried out weighting to one information and selection which considers only one side as an output.

A variable-length-coding method according to claim 33 characterized by things.

[Claim 36]

It is a variable length decoding method used when dividing a picture into two or more blocks and decrypting by making said block into a unit

A variable-length decryption table used when decrypting information on a decryption object block When coding structures whether said decryption object block and said peripheral blocks are coded by the frame structure by determining according to information on peripheral blocks of said decryption object block or to be coded by field structure differ Said variable-length decryption table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks.

A variable length decoding method characterized by things.

[Claim 37]

By a case where coding structures whether said decryption object block and said peripheral blocks are coded by the frame structure or to be coded by field structure differ. And when said variable-length decryption table cannot be determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks said predetermined variable-length decryption table is used.

The variable length decoding method according to claim 36 characterized by things.

[Claim 38]

Said information is the number of a significant coefficient of a block.

The variable length decoding method according to claim 36 characterized by things.

[Claim 39]

When coding structures of said decryption object block and said peripheral blocks differs said variable-length decryption table is determined according to information acquired by equalizing information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral

blocks.

The variable length decoding method according to claim 36 characterized by things.

[Claim 40]

When coding structure of said decryption object block and said peripheral blocks is different information on said peripheral blocks is repealed and said variable-length decryption table is determined according to other information. The variable length decoding method according to claim 36 characterized by things.

[Claim 41]

The 1st peripheral blocks located leftward [of said decryption object block] are contained in said peripheral blocks

When coding structures of said decryption object block and said 1st peripheral blocks differ. [whether said variable-length decryption table is determined according to information acquired by inputting information on the 2nd peripheral blocks corresponding to said 1st peripheral blocks and information on said 1st peripheral blocks into the 1st function and] Or information on said peripheral blocks is made into a predetermined value and said variable-length decryption table is determined according to the predetermined value. The variable length decoding method according to claim 36 characterized by things.

[Claim 42]

The 3rd peripheral blocks located in above [of said decryption object block] are contained in said peripheral blocks

When said decryption object block is coded by the frame structure and said 3rd peripheral blocks are coded by field structure. [whether said variable-length decryption table is determined according to information acquired by inputting information on the 4th peripheral blocks corresponding to said 3rd peripheral blocks and information on said 3rd peripheral blocks into the 1st function and] Or information on said 3rd peripheral blocks is made into a predetermined value and said variable-length decryption table is determined according to the predetermined value.

The variable length decoding method according to claim 36 characterized by things.

[Claim 43]

The 3rd peripheral blocks located in above [of said decryption object block] are contained in said peripheral blocks

When said decryption object block is coded by field structure and said 3rd peripheral blocks are coded by field structure said variable-length decryption table is determined according to information on the 4th peripheral blocks corresponding to said 3rd peripheral blocks.

The variable length decoding method according to claim 36 characterized by things.

[Claim 44]

The 3rd peripheral blocks located in above [of said decryption object block] are contained in said peripheral blocks

When said decryption object block is coded by field structure and said 3rd peripheral blocks are coded by the frame structure. [whether said variable-length decryption table is determined according to information on said 3rd peripheral blocksand] . [whether said variable-length decryption table is determined according to information acquired by inputting information on the 4th peripheral blocks corresponding to said 3rd peripheral blocksand information on said 3rd peripheral blocks into the 1st functionand] Or information on said 3rd peripheral blocks is made into a predetermined valueand said variable-length decryption table is determined according to the predetermined value.

The variable length decoding method according to claim 36 characterized by things.

[Claim 45]

The 1st peripheral blocks located leftward [of said decryption object block] and the 2nd peripheral blocks located in above [of said decryption object block] are contained in said peripheral blocks

Said variable-length decryption table is determined according to information acquired by inputting information on said 1st peripheral blocksand information on said 2nd peripheral blocks into the 2nd function.

The variable length decoding method according to claim 36 characterized by things.

[Claim 46]

Said 1st function is either of the addition which carried out weighting to addition of a value which two information showslogical suma logical productand one information.

The variable length decoding method according to claim 42 or 44 characterized by things.

[Claim 47]

Said 2nd function is either addition of a value which two information showsaddition which carried out weighting to one information and selection which considers only one side as an output.

The variable length decoding method according to claim 45 characterized by things.

[Claim 48]

The 1st peripheral blocks located leftward [of said decryption object block] and the 2nd peripheral blocks located in above [of said decryption object

block] are contained in said peripheral blocks

Said variable-length decryption table is determined according to information acquired by equalizing information on said 1st peripheral blocks and information on said 2nd peripheral blocks.

The variable length decoding method according to claim 36 characterized by things.

[Claim 49]

When either information on said 1st peripheral blocks and information on said 2nd peripheral blocks are invalid said variable-length decryption table is determined according to information on a way which is not invalid

When information on said 1st peripheral blocks and information on said 2nd peripheral blocks are invalid it is decided that it will be the variable-length decryption table decided beforehand.

The variable length decoding method according to claim 36 characterized by things.

[Claim 50]

It is a variable length decoding method used when dividing a picture into two or more blocks and decrypting by making said block into a unit

A probability table used when decrypting information on a decryption object block When coding structures whether said decryption object block and said peripheral blocks are coded by the frame structure by determining according to information on peripheral blocks of said decryption object block or to be coded by field structure differ Said probability table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks.

A variable length decoding method characterized by things.

[Claim 51]

By a case where coding structures whether said decryption object block and said peripheral blocks are coded by the frame structure or to be coded by field structure differ. And when said probability table cannot be determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks said predetermined probability table is used.

The variable length decoding method according to claim 50 characterized by things.

[Claim 52]

Said information is information which shows whether a block has a significant coefficient.

The variable length decoding method according to claim 50 characterized by things.

[Claim 53]

When coding structures of said decryption object block and said peripheral blocks differsaid probability table is determined according to information acquired by inputting information on another peripheral blocks corresponding to said peripheral blocksand information on said peripheral blocks into the 1st function.

The variable length decoding method according to claim 50 characterized by things.

[Claim 54]

When coding structure of said decryption object block and said peripheral blocks is differentinformation on said peripheral blocks is repealed and said probability table is determined according to other information.

The variable length decoding method according to claim 50 characterized by things.

[Claim 55]

The 1st peripheral blocks located leftward [of said decryption object block] and the 2nd peripheral blocks located in above [of said decryption object block] are contained in said peripheral blocks

Said probability table is determined according to information acquired by inputting information on said 1st peripheral blocksand information on said 2nd peripheral blocks into a function.

The variable length decoding method according to claim 50 characterized by things.

[Claim 56]

It is a variable length coding device which divides a picture into two or more blocksand codes by making said block into a unit

A table determination means to determine a variable-length-coding table used when coding information on a coding target block according to information on peripheral blocks of said coding target block

It has an encoding means which performs a variable length code using a determined variable-length-coding table

When coding structures whether said coding target block and said peripheral blocks are coded by the frame structure or to be coded by field structure differsaid table determination meansSaid variable-length-coding table is determined from information on another peripheral blocks corresponding to said peripheral blocksand information on said peripheral blocksor said variable-length-coding table of a predetermined procedure is determined.

A variable length coding device characterized by things.

[Claim 57]

It is a variable length coding device which divides a picture into two or more blocksand codes by making said block into a unit

A table determination means to determine a probability table used when coding

information on a coding target block according to information on peripheral blocks of said coding target block

It has an encoding means which performs a variable length code using a determined probability table

When coding structures whether said coding target block and said peripheral blocks are coded by the frame structure or to be coded by field structure differsaid table determination meansSaid probability table is determined from information on another peripheral blocks corresponding to said peripheral blocksand information on said peripheral blocksor said probability table of a predetermined procedure is determined.

A variable length coding device characterized by things.

[Claim 58]

It is a variable length decoding device which divides a picture into two or more blocksand decrypts by making said block into a unit

A table determination means to determine a variable-length decryption table used when decrypting information on a decryption object block according to information on peripheral blocks of said decryption object block

It has an encoding means which performs a variable length code using a determined variable-length-coding table

When coding structures whether said decryption object block and said peripheral blocks are coded by the frame structure or to be coded by field structure differsaid table determination meansSaid variable-length decryption table is determined from information on another peripheral blocks corresponding to said peripheral blocksand information on said peripheral blocksor said variable-length decryption table of a predetermined procedure is determined.

A variable length decoding device characterized by things.

[Claim 59]

It is a variable length decoding device which divides a picture into two or more blocksand decrypts by making said block into a unit

A table determination means to determine a probability table used when decrypting information on a decryption object block according to information on peripheral blocks of said decryption object block

It has an encoding means which performs a variable length code using a determined probability table

When coding structures whether said decryption object block and said peripheral blocks are coded by the frame structure or to be coded by field structure differsaid table determination meansSaid probability table is determined from information on another peripheral blocks corresponding to said peripheral blocksand information on said peripheral blocksor said probability table of a predetermined procedure is determined.

A variable length decoding device characterized by things.

[Claim 60]

It is a program for a variable length coding device which divides a picture into two or more blocks and codes by making said block into a unit

A table determination step which determines a variable-length-coding table used when coding information on a coding target block according to information on peripheral blocks of said coding target block

A coding step which performs a variable length code using a determined variable-length-coding table is included

When coding structures whether said coding target block and said peripheral blocks are coded by the frame structure or to be coded according to field structure differ in said table determination step Said variable-length-coding table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks or said variable-length-coding table of a predetermined procedure is determined.

A program characterized by things.

[Claim 61]

It is a program for a variable length coding device which divides a picture into two or more blocks and codes by making said block into a unit

A table determination step which determines a probability table used when coding information on a coding target block according to information on peripheral blocks of said coding target block

A coding step which performs a variable length code using a determined probability table is included

When coding structures whether said coding target block and said peripheral blocks are coded by the frame structure or to be coded according to field structure differ in said table determination step Said probability table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks or said probability table of a predetermined procedure is determined.

A program characterized by things.

[Claim 62]

It is a program for a variable length decoding device which divides a picture into two or more blocks and decrypts by making said block into a unit

A table determination step which determines a variable-length decryption table used when decrypting information on a decryption object block according to information on peripheral blocks of said decryption object block

A coding step which performs a variable length code using a determined variable-length-coding table is included

When coding structures whether said decryption object block and said

peripheral blocks are coded by the frame structure or to be coded according to field structure differ in said table determination step Said variable-length decryption table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks or said variable-length decryption table of a predetermined procedure is determined.

A program characterized by things.

[Claim 63]

It is a program for a variable length decoding device which divides a picture into two or more blocks and decrypts by making said block into a unit

A table determination step which determines a probability table used when decrypting information on a decryption object block according to information on peripheral blocks of said decryption object block

A coding step which performs a variable length code using a determined probability table is included

When coding structures whether said decryption object block and said peripheral blocks are coded by the frame structure or to be coded according to field structure differ in said table determination step Said probability table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks or said probability table of a predetermined procedure is determined.

A program characterized by things.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the variable-length-coding method and variable length decoding method at the time of carrying out compression extension of the picture signal.

[0002]

[Description of the Prior Art]

Two methods a context adaptive variable-length-coding (henceforth CAVLC) method and a context adaptive binary arithmetic coding (henceforth CABAC) method are defined as the variable-length-coding method by H.264 coding mode to which the present standards work is performed.

[0003]

In a CAVLC method encoding efficiency is raised by changing a VLC table accommodative using the information on peripheral blocks (context) etc. In a

CABAC method encoding efficiency is raised by changing a probability table according to a context.

[0004]

In a CAVLC method how to code or decrypt the number of the significant coefficient within a block is explained. A significant coefficient is a coefficient whose coefficient value is not 0 here. In drawing 5 the block C is a block which is trying to perform variable length coding and suppose that it is the blocks A and B the block located in the left of the block C and a top respectively. For example by H.264 method each block is not concerned with the size of a motion compensation but frequency conversion is carried out in 4 pixels of levels and the size of 4 pixels of perpendiculars here and the maximum of the number of a significant coefficient is set to 16. In this case both the blocks A and B are in a screen and supposing it is in the same slice two average value will be calculated from the number of the significant coefficient of the blocks A and B and the VLC table used with that value will be changed. for example the case where average value is five or more about VLC1 of drawing 4 when average value is 0 or 1 and average value is 2 or 3 about VLC0 of drawing 4 -- VLC2 of drawing 4 -- it uses so that it may say.

[0005]

Next in a CABAC method how to code or decrypt the bit (CBP bit) which shows whether each block has a significant coefficient is explained. In drawing 5 the block C is a block which is trying to perform variable length coding and suppose that it is the blocks A and B the block located in the left of the block C and a top respectively. In this case supposing both the blocks A and B are in a screen and it is in the same slice and it is the same kind as the block C of block (all of A and C are luminance-signal blocks) It asks for whether it is which pattern in four kinds of whether the blocks A and B have a significant coefficient of combination. And the probability table used with the pattern when carrying out arithmetic coding of the CBP bit is chosen from four.

[0006]

Next in a CABAC method how to code or decrypt the bit which shows whether each coefficient within a block is a significant coefficient is explained. Drawing 6 shows what rearranged the coefficient within a block at the predetermined scanning order forward. By H.264 method the method of scanning from low frequency components to zigzag order to a high frequency component is used here. Under the present circumstances whether each coefficient is a significant coefficient expresses by the bit called a SIG bit and a LAST bit and it carries out arithmetic coding of these bits. A SIG bit is set to 0 here when 1 and a coefficient value are 0 in the case of a significant coefficient. A LAST bit is assigned only to a significant coefficient when the significant coefficient

is a coefficient of the last within a block it is set to 1 and when that is not right it is set to 0. The probability table at the time of carrying out arithmetic coding of a SIG bit and the LAST bit here it is prepared according to the kind (for example the prediction luminance-signal block in a screen picture prediction luminance-signal block the prediction color-difference-signal block etc.) of block and is further prepared for each coefficient position (position in scanning order) of every to the kind of each block. Therefore for example when the kind of a certain block has a maximum of 16 coefficients 15 probability tables are used at a time to each of a SIG bit and a LAST bit. When as for this a significant coefficient exists in the 16th it is because it is not necessary to code the last coefficient.

[0007]

As a context which becomes a factor which chooses a probability table in a CABAC method everything but above-mentioned CBP a SIG bit and a LAST bit -- intra -- there are items -- whether it is a macro block is a skip macro block are a direct mode macro block a reference picture number is 0 or difference QP is 0. And the context value of an object block is determined using the value of the block located in the left of the block which is the target of arithmetic coding and a top about these contexts and variable length coding is performed using the probability table corresponding to the value. The bit string to which variable length coding was performed is described in a code sequence as shown in drawing 24. In drawing 24 the probability table is shown under each information. For example in carrying out variable length coding of MB_type which is the coding mode of a macro block it shows using four probability tables (MB0-MB3) according to a context value.

[0008]

[Problem(s) to be Solved by the Invention]

However in the CAVLC method and CABAC method of the above-mentioned former Since the selection method of a VLC table or a probability table is defined based on the premise that the size of a frequency conversion block (it is only hereafter called transformation blocks) has the same size When the size of transformation blocks is not constant it has the problem that these methods cannot be used.

[0009]

The CAVLC method and CABAC method of the above-mentioned former also have the problem that it does not correspond when a picture signal is an interlace signal. That is since coding and decryption will be performed by a frame or field structure for every block to an interlace signal the case where it is coded/decrypted with the structure where the blocks located in the block and the left for coding/decryption or a top differ occurs but. The deciding method

of variable length coding in the case of such an interlace signal is not defined by a conventional CAVLC method and CABAC method.

[0010]

Then this invention solves the above-mentioned problem.

When the size of transformation blocks is not constant and a CAVLC method and a CABAC method are used for the purpose as the variable-length-coding method it is providing the variable-length-coding method and variable length decoding method which realize the selection method of the VLC table and probability table whose encoding efficiency improves.

[0011]

When a picture signal is an interlace signal and a CAVLC method and a CABAC method are used for this invention as the variable-length-coding method It aims also at providing the variable-length-coding method and variable length decoding method which realize the selection method of the VLC table and probability table whose encoding efficiency improves.

[0012]

[Means for Solving the Problem]

To achieve the above objects a variable-length-coding method of this invention According to composition of claim 1 and claim 2a picture is divided into two or more blocks It is the variable-length-coding method used when coding by making said block into a unit A variable-length-coding table used when coding information on a coding target block When it determines according to information on peripheral blocks of said coding target block and sizes of said coding target block and said peripheral blocks differ it has using information on said peripheral blocks for a size of said coding target block changing it as a feature.

[0013]

According to composition of claim 2 and claim 3a variable-length-coding method of this invention. It is the variable-length-coding method used when dividing a picture into two or more blocks and coding by making said block into a unit a probability table used when coding information on a coding target block When it determines according to information on peripheral blocks of said coding target block and sizes of said coding target block and said peripheral blocks differ it has using information on said peripheral blocks for a size of said coding target block changing it as a feature.

[0014]

According to composition of claim 5a variable-length-coding method of this invention divides a picture into two or more blocks It is the variable-length-coding method used when coding by making said block into a unit and when coding a coefficient value of a coding target block it has using different probability

tables according to a size of a coding target block as a feature.

[0015]

According to composition of claim 6a variable-length-coding method of this invention divides a picture into two or more blocksIt is the variable-length-coding method used when coding by making said block into a unitand when coding a coefficient value of a coding target blockit has using the same probability table regardless of a size of a coding target block as a feature.

[0016]

According to composition of claim 7 and claim 8a variable length decoding method of this invention. It is a variable length decoding method used when dividing a picture into two or more blocks and decrypting by making said block into a unitA variable-length decryption table used when decrypting information on a decryption object blockWhen it determines according to information on peripheral blocks of said decryption object block and sizes of said decryption object block and said peripheral blocks differit has using information on said peripheral blocks for a size of said decryption object blockchanging it as a feature.

[0017]

According to composition of claim 9 and claim 10a variable length decoding method of this invention. It is a variable length decoding method used when dividing a picture into two or more blocks and decrypting by making said block into a unitA probability table used when decrypting information on a decryption object blockWhen it determines according to information on peripheral blocks of said decryption object block and sizes of said decryption object block and said peripheral blocks differit has using information on said peripheral blocks for a size of said decryption object blockchanging it as a feature.

[0018]

According to composition of claim 11a variable length decoding method of this invention divides a picture into two or more blocksIt is a variable length decoding method used when decrypting by making said block into a unitand when decrypting a coefficient value of a decryption object blockit has using different probability tables according to a size of a decryption object block as a feature.

[0019]

According to composition of claim 12a variable length decoding method of this invention divides a picture into two or more blocksIt is a variable length decoding method used when decrypting by making said block into a unitand when decrypting a coefficient value of a decryption object blockit has using the same probability table regardless of a size of a decryption object block as a feature.

[0020]

A variable-length-coding method of this invention divides a picture into two or more blocks. It is the variable-length-coding method used when coding by making said block into a unit. A variable-length-coding table used when coding information on a coding target block. When coding structures whether said coding target block and said peripheral blocks are coded by the frame structure by determining according to information on peripheral blocks of said coding target block or to be coded by field structure differ. Said variable-length-coding table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks or said variable-length-coding table of a predetermined procedure is determined.

[0021]

A variable-length-coding method of this invention divides a picture into two or more blocks. It is the variable-length-coding method used when coding by making said block into a unit. A probability table used when coding information on a coding target block. When coding structures whether said coding target block and said peripheral blocks are coded by the frame structure by determining according to information on peripheral blocks of said coding target block or to be coded by field structure differ. Said probability table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks or said probability table of a predetermined procedure is determined.

[0022]

A variable length decoding method of this invention divides a picture into two or more blocks. It is a variable length decoding method used when decrypting by making said block into a unit. A variable-length decryption table used when decrypting information on a decryption object block. When coding structures whether said decryption object block and said peripheral blocks are coded by the frame structure by determining according to information on peripheral blocks of said decryption object block or to be coded by field structure differ. Said variable-length decryption table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks or said variable-length decryption table of a predetermined procedure is determined.

[0023]

A variable length decoding method of this invention divides a picture into two or more blocks. It is a variable length decoding method used when decrypting by making said block into a unit. A probability table used when decrypting information on a decryption object block. When coding structures whether said decryption object block and said peripheral blocks are coded by the frame

structure by determining according to information on peripheral blocks of said decryption object block or to be coded by field structure differ Said probability table is determined from information on another peripheral blocks corresponding to said peripheral blocks and information on said peripheral blocks or said probability table of a predetermined procedure is determined.

[0024]

This invention is not only realizable as an above-mentioned variable-length-coding method and a variable length decoding method but The feature procedure included in these methods can be realized as a variable length coding device and a variable length decoding device which it has as a means or those procedures can also be realized as a program which a computer is made to execute. And it cannot be overemphasized that such a program can be circulated via transmission media such as recording media such as CD-ROM and the Internet.

[0025]

[Embodiment of the Invention]

An embodiment of the invention is described with reference to drawings.

[0026]

(Embodiment 1)

First overall operation of video coding equipment is explained using drawing 1. Drawing 1 The frame memory 101 the difference operation part 102 the prediction error coding part 103 the code string generation part 104 the prediction error decoding section 105 the add operation part 106 the frame memory 107 the motion vector primary detecting element 108 the mode selection part 109 the encoding controlling part 110 It is a block diagram of the video coding equipment which comprises the switches 111-115.

[0027]

Each picture to which rearrangement was performed by the frame memory 101 presupposes that it is read in the unit of a macro block. Here a macro block presupposes that it is a size of 16 pixels of level 16x perpendiculars. A motion compensation shall be performed by the block unit of 16x16 16x88x168x88x44x8 and 4x4. Suppose that the block which has 16 pixels of levels and a size of 8 pixels of perpendiculars is shown in 16x8 here. Here coding of a forward-addressing prediction-coding picture (P picture) is explained as an example.

[0028]

In coding of P picture the encoding controlling part 110 carries out the switch 113 to one. When P picture is used as a reference picture of other pictures each switch is controlled so that the switches 114 and 115 are turned on. When not used as a reference picture of other pictures the switches 114 and 115 control each switch to be come by off. Therefore the macro block of P picture read from the frame memory 101 is first inputted into the motion

vector primary detecting element 108the mode selection part 109and the difference operation part 102.

[0029]

In the motion vector primary detecting element 108the front motion vector of each block included in a macro block is detected by using the decryption image data of the reference picture accumulated in the frame memory 107 as a forward-addressing picture.

[0030]

In the mode selection part 109the coding mode of a macro block is determined using the motion vector detected in the motion vector primary detecting element 108. Here the coding mode of P picture presupposes that it can choose from the formation of a picture inner codeand prediction coding between pictures by forward addressingfor example. When prediction coding between pictures by forward addressing is usedthe information whether a macro block is divided into what kind of blockand a motion compensation is carried out is also included in coding mode.

[0031]

The coding mode determined by the mode selection part 109 is outputted to the code string generation part 104. The image comparison based on the coding mode determined by the mode selection part 104 is outputted to the difference operation part 102 and the add operation part 106. Howeveran image comparison is not outputted when picture inner code-ization is chosen. When it controls to connect the switch 111 to a and to connect the switch 112 to cwhen picture inner code-ization is chosen by the mode selection part 109 and prediction coding between pictures is chosenit controls to connect the switch 111 to b and to connect the switch 112 to d. Belowthe case where prediction coding between pictures is chosen by the mode selection part 109 is explained.

[0032]

An image comparison is inputted into the difference operation part 102 from the mode selection part 109. In the difference operation part 109the difference of the macro block of P picture and an image comparison is calculatedand a prediction error image is generated and outputted.

[0033]

A prediction error image is inputted into the prediction error coding part 103. In the prediction error coding part 103coding data is generated and outputted by performing coding processing of frequency conversionquantizationetc. to the inputted prediction error image. Herefrequency conversion to a prediction error image shall be performed based on the size of the motion compensation determined in the mode selection part 109. For examplewhen frequency conversion is carried out in the size of 8x8 when a motion compensation is carried out in 8x8 or more sizesand a motion compensation is carried out in

less than 8x8 size frequency conversion shall be carried out in the same size as a motion compensation. The coding data outputted from the prediction error coding part 103 is inputted into the code string generation part 104.

[0034]

In the code string generation part 104 to the inputted coding data variable length coding etc. are performed and a code sequence is generated and outputted by adding the information including coding mode header information etc. that it was inputted from the mode selection part 109.

[0035]

Next overall operation of a video decoding device is explained using drawing 3. Drawing 3 It is a block diagram of the code sequence analyzing parts 301 the prediction error decoding section 302 the mode decoding part 303 the motion compensation decoding part 305 the moving vector storage part 306 the frame memory 307 the add operation part 308 the switches 309 and 310 and the video decoding device that comprises the variable-length decoding section 311.

[0036]

Below the decoding processing of a forward prediction reference mark-ized picture (P picture) is explained.

A code sequence is inputted into the code sequence analyzing parts 301. In the code sequence analyzing parts 301 various data is extracted from the inputted code sequence. Various data is information motion vector information etc. of mode select here. The information on the extracted mode select is outputted to the mode decoding part 303. The extracted motion vector information is outputted to the motion compensation decoding part 305. Prediction error coding data is outputted to the variable length decoding part 311.

[0037]

With reference to the information on the mode select extracted from the code sequence the switches 309 and 710 are controlled by the mode decoding part 303. When mode select is the coding in a picture it controls to connect the switch 309 to a and to connect the switch 710 to c. When mode select is prediction coding between pictures it controls to connect the switch 309 to b and to connect the switch 710 to d.

[0038]

In the mode decoding part 303 the information on mode select is outputted also to a motion compensation section. Below the case where mode select is prediction coding between pictures is explained.

[0039]

In the variable length decoding part 311 variable-length decoding is given to the inputted prediction error coding data. The data given variable-length decoding is outputted to the prediction error decoding section 302.

[0040]

In the prediction error decoding section 302a prediction error image is generated inverse quantization processing and by performing reverse frequency conversion to the inputted data. Here reverse frequency conversion shall be performed based on the size of the motion compensation determined in the mode selection part 109. For example when frequency conversion is carried out in the size of 8x8 when a motion compensation is carried out in 8x8 or more sizes and a motion compensation is carried out in less than 8x8 size frequency conversion shall be carried out in the same size as a motion compensation. The generated prediction error image is outputted to the switch 309. Here since the switch 309 is connected to ba prediction error image is outputted to the add operation part 308.

[0041]

The motion compensation decoding part 305 performs decoding processing to the coded motion vector which was inputted from the variable-length decoding section 311. And based on the decrypted motion vector a frame memory 307 lost-motion compensation picture is acquired. Thus the generated motion compensation picture is outputted to the add operation part 308.

[0042]

In the add operation part 308 the inputted prediction error image and a motion compensation picture are added and a decryption picture is generated. The generated decryption picture is outputted to the frame memory 307 via the switch 310.

[0043]

Now details are explained below about operation of the code string generation part 104 in the video coding equipment explained above and the variable-length decoding section 311 in a video decoding device.

[0044]

First in the code string generation part 104 or the variable-length decoding section 311 how to code or decrypt the number of the significant coefficient of each block with a CAVLC method is explained.

[0045]

In coding or decrypting the number of the significant coefficient of each block it refers to the number of the significant coefficient of peripheral blocks. Here the case where the block located in an object block top and the left is used as peripheral blocks is explained. All peripheral blocks are in a screen and supposing it is in the same slice when coding or decrypting the number of the significant coefficient of an object block a variable-length-coding (decryption) table is determined using the number of the significant coefficient of peripheral blocks. Here when the maximum numbers of the maximum number of the significant coefficient of an object block and the significant coefficient of peripheral blocks differ it asks for the number of the

significant coefficient of peripheral blocks so that the maximum number of the significant coefficient of an object block and peripheral blocks may be coincided. If the maximum of the number of the significant coefficient of an object block is set to N here (for example when the size of an object block is 8x8) It is determined that the variable-length-coding (decryption) table said that it is set to 64 and that N would use VLC2 of drawing 4 if the number of the significant coefficient obtained with reference to peripheral blocks is N / less than [8] it is VLC0 of drawing 4 and less than [more than N/8N/4] and it is VLC1 of drawing 4 and [N / more than 4]. In drawing 4 even when the number of a significant coefficient is 16 the variable-length-coding (decryption) table is shown but these tables presuppose here that what the number of the significant coefficient extended to 17 or more is used. Although explained using drawing 2 below in drawing 2 the block C presupposes that it is the block which is trying to perform variable length coding or variable-length decryption.

[0046]

The 1st example is explained using drawing 2 (a). In drawing 2 (a) the block A1A2B1 and B-2 serve as peripheral blocks located in the left of the block C and a top. The block C has a size of 8x8 and peripheral blocks presuppose it here that it has a size of 8x4. In this case the sum of the number of the significant coefficient of the block B1 and B-2 is used as the number of the significant coefficient of a block located after the block C using the sum of the number of a significant coefficient with the blocks A1 and A2 as the number of the significant coefficient of a block located in the left of the block C. And at the average value of the number of the significant coefficient of a block located in the left of the block C and a top i.e. here The average value of the sum of the number of the significant coefficient of block A1 and A2 and the sum of the number of the significant coefficient of the block B1 and B-2 is calculated and this average value determines the variable-length-coding (decryption) table at the time of coding the number of the significant coefficient of the block C (decryption). Here the number of the significant coefficient of the block B1 which adjoins the block C may be doubled and used instead of using the sum of the number of the significant coefficient of the block B1 and B-2.

[0047]

The 2nd example is explained using drawing 2 (b). In drawing 2 (b) the block A1A2A3A4B1B-2B3 and B4 serve as peripheral blocks located in the left of the block C and a top. The block C has a size of 8x8 and the block A1A2A3A4B1B-2B3 and B4 presuppose it here that it has a size of 4x4. In this case the sum of the number of the significant coefficient of the block B1B-2B3 and B4 is used as the number of the significant coefficient of a block located after the

block C using the sum of the number of the block A1A2A3 and the significant coefficient of A4 as the number of the significant coefficient of a block located in the left of the block C. And at the average value of the number of the significant coefficient of a block located in the left of the block C and a top. i.e. here The average value of the sum of the number of the block A1A2A3 and the significant coefficient of A4 and the sum of the number of the significant coefficient of the block B1B-2B3 and B4 is calculated and this average value determines the variable-length-coding (decryption) table at the time of coding the number of the significant coefficient of the block C (decryption). Here instead of using the sum of the number of A1A2A3 and the significant coefficient of A4 The sum twice value [the block B3] of the number of the significant coefficient of B4 etc. which adjoin the block C may be used instead of using the sum of the number of the sum twice value [the block A2 and] of the number of the significant coefficient of A4 which adjoin the block C and the significant coefficient of the block B1B-2B3 and B4.

[0048]

The 3rd example is explained using drawing 2 (c). In drawing 2 (c) the blocks A and B turn into peripheral blocks located in the left of the block C and a top. The block C has a size of 8x4 and presupposes the blocks A and B here that it has a size of 8x8. In this case one half of the values of the number of the significant coefficient of the block B are used as the number of the significant coefficient of a block located after the block C using one half of the values of the number of the significant coefficient of the block A as the number of the significant coefficient of a block located in the left of the block C. And at the average value of the number of the significant coefficient of a block located in the left of the block C and a top. i.e. here The average value of one half of the values of the number of the significant coefficient of the block A and one half of the values of the number of the significant coefficient of the block B is calculated and this average value determines the variable-length-coding (decryption) table at the time of coding the number of the significant coefficient of the block C (decryption).

[0049]

The 4th example is explained using drawing 2 (d). In drawing 2 (d) the block A1A2B1 and B-2 serve as peripheral blocks located in the left of the block C and a top. The block C has a size of 8x4 and the block A1A2B1 and B-2 presuppose it here that it has a size of 4x8. In this case one half of the values of the sum of the number of the significant coefficient of the block B1 and B-2 are used as the number of the significant coefficient of a block located after the block C using one half of the values of the sum of the number of the significant coefficient of block A1 and A2 as the number of the significant coefficient of a block located in the left of the block C. And at the average

value of the number of the significant coefficient of a block located in the left of the block C and a top. i.e. here The average value of one half of the values of the sum of the number of the significant coefficient of block A1 and A2 and one half of the values of the sum of the number of the significant coefficient of the block B1 and B-2 is calculated and this average value determines the variable-length-coding (decryption) table at the time of coding the number of the significant coefficient of the block C (decryption). Here the number of either significant coefficient of the block B1 and B-2 etc. may be used instead of using the sum of the number of the number of one significant coefficient of block A1 and A2 and the significant coefficient of the block B1 and B-2 instead of using the sum of the number of the significant coefficient of A1 and A2.

[0050]

The 5th example is explained using drawing 2 (e). In drawing 2 (e) the block A1A2A3A4B1B-2B3 and B4 serve as peripheral blocks located in the left of the block C and a top. The block C has a size of 8x4 and the block A1A2A3A4B1B-2B3 and B4 presuppose it here that it has a size of 4x4. In this case the sum of the number of the significant coefficient of the block B3 and B4 is used as the number of the significant coefficient of a block located after the block C using the sum of the number of the significant coefficient of block A1 and A2 as the number of the significant coefficient of a block located in the left of the block C. And at the average value of the number of the significant coefficient of a block located in the left of the block C and a top. i.e. here The average value of the sum of the number of the significant coefficient of block A1 and A2 and the sum of the number of the significant coefficient of the block B3 and B4 is calculated and this average value determines the variable-length-coding (decryption) table at the time of coding the number of the significant coefficient of the block C (decryption). Here instead of using the sum of the number of the significant coefficient of A1 and A2 One half of the values of the sum of the number of the block A1A2A3 and the significant coefficient of A4 One half of the values of the sum of the number of the significant coefficient of the block B1B-2B3 and B4 etc. may be used instead of using the sum of the number of the significant coefficient of the block B3 and B4.

[0051]

The 6th example is explained using drawing 2 (f). In drawing 2 (f) the blocks A and B turn into peripheral blocks located in the left of the block C and a top. The block C has a size of 4x4 and presupposes the blocks A and B here that it has a size of 8x8. In this case one fourth of the values of the number of the significant coefficient of the block B are used as the number of the significant coefficient of a block located after the block C using one fourth

of the values of the number of the significant coefficient of the block A as the number of the significant coefficient of a block located in the left of the block C. And at the average value of the number of the significant coefficient of a block located in the left of the block C and a top, i.e. here the average value of one fourth of the values of the number of the significant coefficient of the block A and one fourth of the values of the number of the significant coefficient of the block B is calculated and this average value determines the variable-length-coding (decryption) table at the time of coding the number of the significant coefficient of the block C (decryption).

[0052]

The 7th example is explained using drawing 2 (g). In drawing 2 (g) the block A1A2B1 and B-2 serve as peripheral blocks located in the left of the block C and a top. Suppose the block C here that it has a size of 4x4 and has the block A1A2B1B-2 and a size of 4x8. In this case one half of the values of the number of the significant coefficient of the block B1 are used as the number of the significant coefficient of a block located after the block C using one half of the values of the number of the significant coefficient of the block A2 as the number of the significant coefficient of a block located in the left of the block C. And at the average value of the number of the significant coefficient of a block located in the left of the block C and a top, i.e. here the average value of one half of the values of the number of the significant coefficient of the block A2 and one half of the values of the number of the significant coefficient of the block B1 is calculated and this average value determines the variable-length-coding (decryption) table at the time of coding the number of the significant coefficient of the block C (decryption). Here one fourth of the values of the sum of the number of the significant coefficient of the block B1 and B-2 etc. may be used instead of using one fourth of the values of the sum of the number of the significant coefficient of block A1 and A2 and one half of the values of the number of the significant coefficient of the block B1 instead of using one half of the values of the number of the significant coefficient of A2.

[0053]

Next in the code string generation part 104 or the variable-length decoding section 311 how to code or decrypt the bit (CBP bit) which shows whether each block has a significant coefficient with a CABAC method is explained.

[0054]

When coding or decrypting the CBP bit of each block the CBP bit of peripheral blocks is referred to. Here the case where the block located in an object block top and the left is used as peripheral blocks is explained. Supposing all peripheral blocks are in a screen and it is in the same slice and it is the same kind as a coding (decryption) object block when coding or decrypting the

CBP bit of an object block the existence of the significant coefficient of peripheral blocks determines the probability table in the case of variable length coding (decryption). In this case, [whether the total value of the number of the significant coefficient of a block located in the left of an object block is 0 and] And it asks for whether the total value of the number of the significant coefficient of a block located on an object block is 0 and any of four kinds of combination of ** they are and the probability table used when carrying out arithmetic coding of the CBP bit of an object block by it is chosen from four kinds. Here when the maximum numbers of the maximum number of the significant coefficient of an object block and the significant coefficient of peripheral blocks differ it asks for a CBP bit so that the maximum number of the significant coefficient of an object block and peripheral blocks may be coincided. Although explained using drawing 2 below in drawing 2 the block C presupposes that it is the block which is trying to perform variable length coding or variable-length decryption.

[0055]

The 1st example is explained using drawing 2 (a). In drawing 2 (a) the block A1A2B1 and B-2 are peripheral blocks located in the left of the block C and a top respectively. In this case ask for whether the total value of the number of the significant coefficient of whether the total value of the number of a significant coefficient with the blocks A1 and A2 is 0 the block B1 and B-2 is 0 and any of four kinds of combination of ** they are and by it. The probability table used when carrying out arithmetic coding of the CBP bit of the block C is chosen. . [whether the sum of the number of a significant coefficient with the blocks A1 and A2 is 0 in this case and] The decision criterion whether the number of the significant coefficient of the block A1 (or block A2) is 0 instead of using the decision criterion to say Instead of using the decision criterion whether the sum of the number of the significant coefficient of the block B1 and B-2 is 0 the decision criterion whether the number of the significant coefficient of the block B1 (or block B-2) is 0 may be used.

[0056]

The 2nd example is explained using drawing 2 (b). In drawing 2 (b) the block A1A2A3A4B1B-2B3 and B4 are peripheral blocks located in the left of the block C and a top respectively. In this case, [whether the total value of the number of the significant coefficient of the block A1A2A3 and A3 is 0 and] And it asks for whether the total value of the number of a significant coefficient with the block B1B-2B3 and B4 is 0 and any of four kinds of combination of ** they are and the probability table used when carrying out arithmetic coding of the CBP bit of the block C by it is chosen. . [whether the sum of the number of the block A1A2A3 and the significant coefficient of A4 is 0 in this case and] The decision criterion whether the sum of the number of the significant

coefficient of the block A2 which adjoins the block C and A4 is 0 instead of using the decision criterion to say whether the sum of the number of the significant coefficient of the block B3 and B4 which adjoin the block C is 0 may be used instead of using the decision criterion whether the sum of the number of the significant coefficient of the block B1-B2-B3 and B4 is 0.

[0057]

The 3rd example is explained using drawing 2 (c). In drawing 2 (c) the blocks A and B are peripheral blocks located in the left of the block C and a top respectively. In this case it asks for whether the number of the significant coefficient of whether the number of the significant coefficient of the block A is 0 and the block B is 0 and any of four kinds of combination of ** they are and the probability table used when carrying out arithmetic coding of the CBP bit of the block C by it is chosen. . [whether the number of the significant coefficient of the block A (block B) is 0 in this case and] ***** [that one half of the number of the significant coefficient of the block A (block B) is 0 instead of using the decision criterion to say] -- the decision criterion to say and the decision criterion whether the number of the significant coefficient of the block A (block B) is beyond a predetermined value or it is the following may be used.

[0058]

The 4th example is explained using drawing 2 (d). In drawing 2 (d) the block A1-A2-B1 and B-2 are peripheral blocks located in the left of the block C and a top respectively. In this case ask for whether the sum of the number of the significant coefficient of whether the sum of the number of a significant coefficient with the blocks A1 and A2 is 0 the block B1 and B-2 is 0 and any of four kinds of combination of ** they are and by it. The probability table used when carrying out arithmetic coding of the CBP bit of the block C is chosen. . [whether the sum of the number of the significant coefficient of the blocks A1 and A2 (the block B1 and B-2) is 0 in this case and] ***** [that one half of the sums of the number of the significant coefficient of the blocks A1 and A2 (the block B1 and B-2) is 0 instead of using the decision criterion to say] -- the decision criterion to say. The decision criterion whether the number of the significant coefficient of the blocks A1 and A2 (the block B1 and B-2) is beyond a predetermined value or it is the following may be used.

[0059]

The 5th example is explained using drawing 2 (e). In drawing 2 (e) the block A1-A2-A3-A4-B1-B-2-B3 and B4 are peripheral blocks located in the left of the block C and a top respectively. In this case ask for whether the sum of the number of the significant coefficient of whether the sum of the number of a significant coefficient with the blocks A1 and A2 is 0 the block B3 and B4 is 0 and any of

four kinds of combination of ** they are and by it. The probability table used when carrying out arithmetic coding of the CBP bit of the block C is chosen. . [whether the sum of the number of the significant coefficient of the blocks A1 and A2 is 0 in this case and] Instead of using the decision criterion to say the block A1A2A3 the sum of the number of the significant coefficient of A4 or. [whether it is whether one half of the sums is 0 and beyond a predetermined value or it is the following and] . [whether the sum of the number of the significant coefficient of a decision criterion and the block B3 and B4 to say is 0 and] Instead of using the decision criterion to say the decision criterion whether to be whether one half of the sums (omission value) is 0 and beyond [the block B1B-2 B3 the sum of the number of the significant coefficient of B4 or] a predetermined value or to be the following etc. may be used.

[0060]

The 6th example is explained using drawing 2 (f). In drawing 2 (f) the blocks A and B are peripheral blocks located in the left of the block C and a top respectively. In this case it asks for whether the number of the significant coefficient of whether the number of the significant coefficient of the block A is 0 and the block B is 0 and any of four kinds of combination of ** they are and the probability table used when carrying out arithmetic coding of the CBP bit of the block C by it is chosen. . [whether the number of the significant coefficient of the block A (block B) is 0 in this case and] ***** [that one fourth of the number of the significant coefficient of the block A (block B) is 0 instead of using the decision criterion to say] -- the decision criterion to say the decision criterion whether the number of the significant coefficient of the block A (block B) is beyond a predetermined value or it is the following etc. may be used.

[0061]

The 7th example is explained using drawing 2 (g). In drawing 2 (g) the block A1A2B1 and B-2 are peripheral blocks located in the left of the block C and a top respectively. In this case it asks for whether the number of the significant coefficient of whether the number of the significant coefficient of the block A2 is 0 and the block B1 is 0 and any of four kinds of combination of ** they are and the probability table used when carrying out arithmetic coding of the CBP bit of the block C by it is chosen. . [whether the number of the significant coefficient of the block A2 (block B1) is 0 in this case and] ***** [that one half of the number of the significant coefficient of the block A2 (block B1) is 0 instead of using the decision criterion to say] . . [whether the number of the significant coefficient of the block A2 (block B1) is beyond a predetermined value or it is the following and] The decision criterion whether to be whether one half of the sums (omission value) is 0 and

beyond [the sum of the number of the decision criterion to say and the significant coefficient of the blocks A1 and A2 (the block B1 and B-2) or] a predetermined value or to be the following etc. may be used.

[0062]

Next in the code string generation part 104 or the variable-length decoding section 311 the encoding method of the bit which shows whether each coefficient within a block is a significant coefficient with a CABAC method is explained. As it explained the coefficient within a block using drawing 6 in explanation of a conventional example after rearranging at a predetermined scanning order foreword it is expressed using a SIG bit and a LAST bit and presupposes that arithmetic coding of these bits is carried out.

[0063]

In the 1st example the probability table at the time of carrying out arithmetic coding of a SIG bit and the LAST bit is prepared according to the size of a block. That is a probability table is prepared as it was called the probability table for 4x4 blocks the probability table for 4x8 blocks the probability table for 8x4 blocks and the probability table for 8x8 blocks. And a probability table is prepared for each coefficient position (position in scanning order) of every for every kind of each block. Therefore for example to 4x4 blocks 15 probability tables are used at a time to each of a SIG bit and a LAST bit and 63 probability tables use at a time to each of a SIG bit and a LAST bit to 8x8 blocks. When as for this a significant coefficient exists in the final position it is because it is not necessary to code this coefficient.

[0064]

Let the probability tables at the time of carrying out arithmetic coding of a SIG bit and the LAST bit be 1 set of tables regardless of the size of a block in the 2nd example. That is a probability table is prepared according to the greatest block size. Here supposing the greatest block size is 8x8 63 probability tables will be used at a time to each of a SIG bit and a LAST bit. And to 4x4 blocks the first 31 probability tables are used to 4x8 blocks or 8x4 blocks using the first 15 probability tables.

[0065]

As mentioned above the variable-length-coding method of this invention and a variable length decoding method When coding the number of the significant coefficient of each block with a CAVLC method and the size of a coding target block differs from the size of peripheral blocks The number of the significant coefficient of peripheral blocks is changed based on the ratio of the size of a coding target block and peripheral blocks and this changed value is used for the determination of a variable-length-coding table.

[0066]

By the above operation even if it is a case where the size of a coding target

block differs from the size of peripheral blocks the variable-length table according to the size of the coding target block can be determined and improvement in encoding efficiency can be aimed at.

[0067]

When each block codes the bit (CBP bit) which shows whether it has a significant coefficient with a CABAC method the variable-length-coding method of this invention The size of a coding target block When the sizes of peripheral blocks differ the existence of the significant coefficient of peripheral blocks is changed based on the ratio of the size of a coding target block and peripheral blocks and this changed value is used for the determination of the probability table used in a CABAC method.

[0068]

By the above operation even if it is a case where the size of a coding target block differs from the size of peripheral blocks the probability table according to the size of the coding target block can be determined and improvement in encoding efficiency can be aimed at.

[0069]

When the bit which shows whether each coefficient within a block is a significant coefficient with a CABAC method carries out the encoding method of the variable-length-coding method of this invention it prepares a probability table according to the size of a coding target block and prepares the probability table of a different group for every block size. Or a probability table is prepared according to the maximum block size of a coding target block and it is not concerned with the difference in the size of a block but the group of the same probability table is used.

[0070]

By the above operation even if it is a case where a block has two or more sizes improvement in encoding efficiency can be aimed at by having a group of a probability table for each size of a block. By preparing a probability table according to the maximum of the size of a block and not being concerned with the difference in the size of a block but using the group of the same probability table the number of probability tables can be reduced and memory size can be made small.

[0071]

In this embodiment although a macro block is a unit of 16 pixels of level 16x16 perpendiculars and the motion compensation explained the case where it is processed by a 16x16 to 4x4-pixel block unit another pixel number may be sufficient as these units.

[0072]

In this embodiment although the case where frequency conversion was processed by one block unit of 8x8x4x8 and 4x4 was explained another pixel number may be

sufficient as these units.

[0073]

In this embodiment although the case where a variable-length-coding table and a probability table were determined was explained with reference to the block located in the left and a top as peripheral blocks of a coding target block these peripheral blocks may be other blocks. For example there are a method of using the block of the upper right or the upper left etc. etc.

[0074]

In this embodiment in explanation of a CAVLC method although the case where three variable-length-coding tables shown in drawing 4 were used was explained about the number of a variable-length-coding table and the composition of a table it does not restrict to drawing 4. These values may be other values although the case where values such as $N/8$ and $N/4$ were used as a threshold to the number of the significant coefficient of peripheral blocks was explained. Different thresholds for every size of a coding target block may be used.

[0075]

What is necessary is just to make a decision of a variable-length-coding table or a probability table only using the peripheral blocks which fulfill conditions when these peripheral blocks do not fulfill this condition although peripheral blocks are in a screen and the case where it was in the same slice was explained by this embodiment.

[0076]

(Embodiment 2)

Next when the frame structure or field structure is intermingled to an interlace signal in every macro block or every MBP (macro block pair; it is described as the following MBP) and it performs video coding and video decryption how to determine a context using a CAVLC method or a CABAC method is explained. MBP is the unit which summarized two macro blocks which adjoin up and down here and detailed composition is mentioned later.

[0077]

Drawing 7 is a functional block diagram showing the composition of the video coding equipment concerning this Embodiment 2. In addition to the composition shown in the video coding equipment concerning Embodiment 1 mentioned above in this Embodiment 2 it has the block counter 701.

[0078]

This block counter 701 points to the output in the block unit which is the target of variable length coding to said frame memory 101 and directs whether that object block is a boundary of MBP to said coding generation part 104. In the mode selection part 109 it determines by any the MBP concerned shall be coded between the frame structure and field structure and the result is outputted to the code string generation part 104. The coding generation part

104 starts variable length coding of the object block concerning this Embodiment 2 using the boundary information of MBP outputted from the block counter 70 and the structure information on MBP outputted from the mode selection part 109. Overall operation of video coding equipment is the same as the operation mentioned above.

[0079]

Drawing 8 is an explanatory view showing the relation between the data structure of MBP coded by the frame structure and the data structure of MBP coded by field structure. In the figure a white round head shows the pixel on an odd number horizontal scanning line and the black dot which carried out hatching with the slash shows the pixel on an even number horizontal scanning line. When MBP is started from each frame showing an inputted image the pixel on an odd number horizontal scanning line and the pixel on an even number horizontal scanning line are perpendicularly arranged by turns so that it may be shown in the center of drawing 8. When coding such MBP by the frame structure the MBP concerned is processed every two macro block 1 and macro block 2. The MBP concerned is divided into the macro block MBt showing the top field at the time of carrying out an interlace to a horizontal scanning line direction and the macro block MBb showing a bottom field when coding by field structure.

[0080]

Drawing 9 is a flow chart which shows the big flow of the computational procedure in the case of the CAVLC method concerning this Embodiment 2 determining a context and determining a corresponding VLC table.

[0081]

The physical relationship of the block A and the block B which is peripheral blocks of coding target block C is explained as the same thing as said drawing 5. Coding target block C and peripheral-blocks A and B have a size of 4x4 pixels (coefficient) and explain the maximum of the number of the significant coefficient of each block as 16. The number of the significant coefficient of peripheral-blocks B located on NL and coding target block C in the number of the significant coefficient of peripheral-blocks A located in the left of coding target block C is set to NU.

[0082]

First the code string generation part 104 determines number NL of the significant coefficient of object block A located in the left of coding target block C (Step 901). Next the number N of the significant coefficient of an object block is determined by determining the number of the significant coefficient NU of object block B located on coding target block C (Step 902) and finally using them NL and NU (Step 903).

[0083]

A decision of N is made by the method of mentioning later and the VLC table corresponding to the value of N is determined as a VLC table used for a variable length code.

[0084]

Here the relation of the number N of a significant coefficient and the VLC table which were determined eventually is as in the table shown in drawing 10 for example. Here the number N of a significant coefficient in the case of 0 to 2 It is shown using the table of VLC0 shown in drawing 4 that the number N of a significant coefficient uses [in the number N of a significant coefficient / in the case of 3 to 10] the VLC table of VLC2 using the VLC table of VLC1 in the case of 11 to 16.

[0085]

Hereafter a procedure with each detailed step in the flow chart shown in drawing 9 is explained.

Drawing 11 is Step 901 in drawing 9 and a flow chart which shows the details of the computational procedure (two kinds (a) and (b)) which is got blocked and calculates number NL of the significant coefficient of peripheral-blocks A.

[0086]

First when the 1st operation procedures are explained using drawing 11 (a) the code string generation part 104 Since these two blocks are the same types if it investigates whether peripheral-blocks A located in the left of coding target block C is located in the same MBP (Step 1101) and is in the same MBP As a number NL of the significant coefficient of peripheral-blocks A it specifies by $NL = \text{Num}(A)$ (Step 1104). Num(x) shows the number of the significant coefficient of the block x here. A type refers to the coding structure whether the target block is coded by field structure or to be coded by the frame structure.

[0087]

And when it is judged that peripheral-blocks A is not located in the same MBP peripheral-blocks A investigates whether it is MBP same type as object block C (Step 1102). As a result when peripheral-blocks A and object block C are MBP(s) same type it is considered as $NL = \text{Num}(A)$ and (Step 1104) and when those types differ it computes as $NL = (\text{Num}(A) + \text{Num}(A')) / 2$ (Step 1103).

Peripheral-blocks A' is the block corresponding to the block A and mentions the detailed physical relationship later.

[0088]

Next if it investigates whether peripheral-blocks A located in the left of coding target block C is located in the same MBP (Step 1101) and is in the same MBP when the 2nd operation procedures are explained using drawing 11 (b) It is considered as $NL = \text{Num}(A)$ using the number of the significant coefficient of peripheral-blocks A (Step 1104) and when it is judged that peripheral-blocks A is not located in the same MBP peripheral-blocks A is

investigated in MBP same type as object block C (Step 1102). And peripheral-blocks A considers it as $NL = \text{Num}(A)$ and (Step 1104) when it is MBP same type as object block C and when those types differ it is taken as $NL = N - A$ (Not Available; unfixed) (Step 1105).

[0089]

Drawing 12 is a figure showing an example of arrangement of peripheral-blocks A in case coding target block C is field structure and the frame structure and A'.

Drawing 12 (a) shows the case where belong to MBP1201 by which coding target block C was coded by field structure and it belongs to MBP1202 by which peripheral-blocks A was coded by the frame structure. Peripheral-blocks A' will be located under peripheral-blocks A. This is because correspondence relations are determined so that the scanning line of the pixel belonging to each block may become the same so that MBP of the frame structure and field structure which were shown in drawing 8 may show. That is since the block A and A' distribute the number of the significant coefficient of the block A and A' has been used for the scanning line belonging to the block C as an NL used for determining the number of the significant coefficient of the block C.

[0090]

On the other hand drawing 12 (b) shows the case where belong to MBP1203 by which coding target block C was coded by the frame structure and it belongs to MBP1204 by which peripheral-blocks A was coded by field structure. Peripheral-blocks A' is located in the same relative position in MB located under MB to which peripheral blocks belong. Since the block A and A' distribute the reason as above-mentioned drawing 12 (a) this is the same i.e. the scanning line belonging to the block C is for adopting the number of the significant coefficient of the block A and A' as an NL used for determining the number of the significant coefficient of the block C.

[0091]

Drawing 13 is Step 902 in drawing 9 and a flow chart explaining the details of the computational procedure (two kinds (a) and (b)) which is got blocked and asks for the number NU of the significant coefficient of peripheral-blocks B using a CAVLC method.

[0092]

In drawing 13 (a) in which the 1st computational procedure is shown the code string generation part 104 investigates whether the block or macro block located in peripheral-blocks B is located in the same MBP (Step 1301). Since these blocks serve as the same type when located in the same MBP it is considered as $NU = \text{Num}(B)$ as the number NU of the significant coefficient of peripheral-blocks B (Step 1305). And when not located in the same MBP coding target block C investigates whether it is the frame structure (Step 1302). In

being not the frame structure but field structure it investigates continuously whether peripheral-blocks B is the frame structure (Step 1303) and when peripheral-blocks B is the frame structure it is considered as $NU = \text{Num}(B)$ and (Step 1305) as the number NU of the significant coefficient of peripheral-blocks B. When peripheral-blocks B is field structure it computes as $Nu = (\text{Num}(B) + \text{Num}(B')) / 2$ as the number Nu of a significant coefficient (Step 1308).

[0093]

And when object block C is said field structure it investigates whether peripheral-blocks B is field structure (Step 1304) and when peripheral-blocks B is field structure it is considered as $NU = \text{Num}(B')$ (Step 1306) as the number NU of a significant coefficient. On the other hand when peripheral-blocks B is the frame structure it computes as the number Nu of a significant coefficient as $NU = \text{Num}(B)$ or $NU = (\text{Num}(B) + \text{Num}(B')) / 2$ (Step 1307). And it continues to said step 803 through said each step.

[0094]

In drawing 13 (b) in which the 2nd computational procedure is shown. When the block or macro block located in peripheral-blocks B investigates whether it is located in the same MBP (Step 1301) and is located in the same MBP. Since these blocks are the same type they are made into $NU = \text{Num}(B)$ as the number NU of the significant coefficient of peripheral-blocks B (Step 1305). And when not located in the same MBP. Coding target block C investigates whether it is the frame structure (Step 1302) and in not being the frame structure then it investigates whether peripheral-blocks B is the frame structure (Step 1303) and when peripheral-blocks B is the frame structure it is considered as $NU = N - A$ (unfixed) (Step 1305) as the number NU of a significant coefficient. When peripheral-blocks B is field structure it computes as $Nu = (\text{Num}(B) + \text{Num}(B')) / 2$ as the number of a significant coefficient (Step 1308). And when object block C is said field structure. Investigate whether peripheral-blocks B is field structure (Step 1304) and when peripheral-blocks B is field structure while considering it as $NU = \text{Num}(B')$ (Step 1306) as the number NU of a significant coefficient when peripheral-blocks B is the frame structure as the number Nu of a significant coefficient it is considered as $NU = N - A$ (unfixed) (Step 1307) and continues to said step 903.

[0095]

Drawing 14 is a figure showing an example of arrangement of peripheral-blocks B in case coding target block C is field structure and the frame structure and B'.

[0096]

Drawing 14 (a) shows the case where belong to MBP1401 by which coding target block C was coded by field structure and it belongs to MBP1402 by which

peripheral-blocks B was coded by the frame structure. Peripheral-blocks B' is located on peripheral-blocks B. This so that MBP of the frame structure and field structure which were shown in drawing 8 may show the block C of field structure. Since it becomes the same as that of the block B which follows two length of the frame structure and B' as a spatial size the number of the significant coefficient of the block B and B' has been adopted as NU used for determining the number of the significant coefficient of the block C. However spatially since it is discontinuous to the block C and block B' as shown in S1307 $NU = \text{Num}(B)$ or $NU = (\text{Num}(B) + \text{Num}(B')) / 2$ and two kinds of calculation methods can be considered.

[0097]

On the other hand drawing 14 (b) shows the case where belong to MBP1401 by which coding target block C was coded by field structure and it belongs to MBP1403 by which peripheral-blocks B was also coded by field structure. Peripheral-blocks B' is located in the same relative position in MB located on MB to which peripheral-blocks B belongs. Since the block C and B' belong to MB coded with the same kind of field (top field/bottom field) structure this is for adopting the number of the significant coefficient of block B' as NU used for determining the number of the significant coefficient of the block C.

[0098]

Further on the other hand drawing 14 (c) shows the case where belong to MBP1404 by which coding target block C was coded by the frame structure and it belongs to MBP1403 by which peripheral blocks were coded by field structure. Peripheral-blocks B' is located in the same relative position in MB located on MB to which peripheral-blocks B belongs. Since the spatial position in MBP is the same field the block B and B' of this are for adopting the number of the significant coefficient of the block B and B' as NU used for determining the number of the significant coefficient of the block C.

[0099]

Next drawing 15 is Step 903 in drawing 9 and a flow chart which shows the details of the decision procedure (two kinds (a) and (b)) of the VLC table which is got blocked and applied to this Embodiment 2.

[0100]

In drawing 15 (a) in which the 1st decision procedure is shown the code string generation part 104 determines the number N of the significant coefficient of coding target block C by $N = (NL + NU) / 2$ using the number NL and NU of the significant coefficient of the object blocks B and A first (Step 1501). Next it becomes possible to determine a VLC table using the table shown in this N and said drawing 10 (Step 1502).

[0101]

In drawing 15 (b) in which the 2nd decision procedure is shown Either NL or NU

investigates first whether it is N-A (unfixed) (Step 1503) and when NL and NU are unfixed the code string generation part 104 it [it] For example adopt a default of using the VLC table of $N=0$ (Step 1504) and on the other hand when only NU is unfixed Consider it as $N=NL$ determine the VLC table corresponding to the N (Step 1505) and further on the other hand when only NL is unfixed it being considered as $N=NU$ and the N determining a VLC table (Step 1506) and When neither NL nor NU is unfixed (i.e. when having determined both NL and NU) others can be adopted it can compute as $N=(NL+NU)/2$ and a VLC table can be determined (Step 1507).

[0102]

Next the decision procedure of the probability table used for the context of the CABAC method concerning this Embodiment 2 is explained.

Drawing 16 is a flow chart which shows the big flow of the computational procedure in the case of the CABAC method concerning this Embodiment 2 determining a context and determining a corresponding probability table. The code string generation part 104 determines first the context value $ctxA$ of peripheral-blocks A located in the left of coding target block C (Step 1601) and determines the context value $ctxB$ of peripheral-blocks B located on coding target block C next (Step 1602). And the context value $ctxC$ of coding target block C is determined by using the value of these $ctxA(s)$ and $ctxB$ (Step 1603).

And variable length coding is performed using the probability table corresponding to the determined context value $ctxC$.

[0103]

Hereafter a procedure with each detailed step in the flow chart shown in drawing 16 is explained.

Drawing 17 is Step 1601 in drawing 16 and a flow chart which shows the details of the computational procedure (two kinds (a) and (b)) which is got blocked and calculates the context value $ctxA$ of peripheral-blocks A using a CABAC method. Here the values which can be taken differ by what kind of information including a CBP bit the coding mode of a macro block a reference picture number a differential PCM parameter etc. a context value treats. For example when a context is divided into 0 and 1 by the existence of the significant coefficient of each block when coding a CBP bit (bit which shows whether it has a significant coefficient) for example there is a significant coefficient it is set to 1 and it is set to 0 when a significant coefficient is not contained. Therefore a context value here corresponds to the existence or nonexistence of a significant coefficient. In addition when coding the coding mode of a macro block each block is a skip block or a context is the block coded by the direct mode or is divided into 0 and 1 by ** respectively. A reference picture number and a differential PCM parameter are divided into 0 and 1 by whether it is 0.

[0104]

If the 1st computational procedure is explained using drawing 17 (a) the code string generation part 104 will investigate whether it is in the MBP as coding target block C with same block or macro block located in peripheral-blocks A (Step 1701). If it is in the same MBP it will be considered as $ctxA = ctx(A)$ and (Step 1704) as the context value $ctxA$ of peripheral-blocks A. $ctx(x)$ shows the context value of the block x here.

[0105]

when peripheral-blocks A does not come out in the same MBP as coding target block C it is investigated whether peripheral-blocks A is MBP of the type of the same structure as coding target block C (Step 1702). In this case if it is a type of the same structure it will be considered as $ctxA = ctx(A)$ and (Step 1704) as the context value $ctxA$ of peripheral-blocks A. On the other hand in being the block of the type with which the structures of peripheral-blocks A and object block C differ it computes with context value $ctxA = F1(ctx(A), ctx(A'))$ as the context value $ctxA$ of peripheral-blocks A (Step 1703). Here $F1$ is a function which performs a certain math operation for example is $F1(a, b) = a + b + 2$ and $a \& b$. And it continues to said step 1602.

[0106]

And if the 2nd operation procedures are explained using drawing 17 (b) the block or macro block located in peripheral-blocks A investigates whether it is in the same MBP as coding target block C (Step 1701) and if it is in the same MBP as the context value $ctxA$ of peripheral-blocks A it is considered as $ctxA = ctx(A)$ and (Step 1704) when peripheral-blocks A does not come out in the same MBP as coding target block C peripheral-blocks A investigates whether it is MBP of the type of the same structure as coding target block C (Step 1702). In this case if it is a type of the same structure as the context value $ctxA$ of peripheral-blocks A while considering it as $ctxA = ctx(A)$ and (Step 1704) in being the block of the type with which the structures of peripheral-blocks A and object block C differ it sets the context value $ctxA$ as a default value (Step 1705). As this default value it is either of the values which a context value can take for example is 0 or 1.

[0107]

Drawing 18 is Step 1602 in drawing 16 and a flow chart which shows the details of the computational procedure (two kinds (a) and (b)) which is got blocked and calculates the context value of peripheral-blocks B using a CABAC method.

[0108]

In drawing 18 (a) in which the 1st computational procedure is shown the block or macro block to which the code string generation part 104 is located in peripheral-blocks B investigates first whether it is MBP (Step 1801). When located in the same MBP it is considered as context value $ctxB = ctx(B)$ and

(Step 1805). And when object block C is not located in the same MBP as peripheral-blocks Bit is investigated whether object block C is the frame structure (Step 1802). As a result when object block C is the frame structure peripheral-blocks B investigates whether it is the frame structure (Step 1803). When peripheral-blocks B is the frame structure it is considered as context value $ctxB = ctx(B)$ and (Step 1805). On the other hand when object block C is the frame structure and peripheral-blocks B is field structure it is considered as context value $ctxB = F1(ctx(B), ctx(B'))$ (Step 1808).

[0109]

When object block C is field structure next peripheral-blocks B investigates whether it is field structure (Step 1804). When peripheral-blocks B is field structure it is considered as context value $ctxB = ctx(B')$ (Step 1806). When object block C is field structure and peripheral-blocks B is the frame structure it is considered as context value $ctxB = ctx(B)$ or $ctxB = F1(ctx(B), ctx(B'))$ (Step 1807). Processing of F1 becomes being the same as that of *** here. And it continues to said step 1603 through said each step.

[0110]

Drawing 19 is Step 1603 in drawing 16 and a flow chart which shows the details of the decision procedure of the probability table which is got blocked and applied to this Embodiment 2.

In drawing 19 it is a step following said drawing 18 and the code string generation part 104 sets the context value of coding target block C to $ctxC = F2(ctx(A), ctx(B))$ first (Step 1901). Here F2 is a function which performs a certain math operation like F1 for example is $F2(ab) = a + ba + 2ba \& ba$ and b. Next a probability table can be determined by using this $ctxC$ (Step 1902).

[0111]

The deciding method of the context in the deciding method of a VLC table [in / not only on the video coding mentioned above but video decryption and / the CAVLC method] and the CABAC method It becomes the operation in the variable length decoding part 311 shown in said drawing 3 and the same operation as said code string generation part 104 is performed. . In the variable length decoding part 311 when making the determination of a VLC table and a decision of a context are needed here. The information which shows whether a block is a boundary of MBP and whether MBP is coded with which structure of a frame or the field again is acquired from the code sequence analyzing parts 301.

[0112]

As mentioned above in the variable-length-coding method and variable length decoding method concerning Embodiment 2 when using a CAVLC method and a CABAC method the information on the significant coefficient of two or more peripheral blocks is used. Therefore the selection method of the VLC table and probability table whose encoding efficiency improves more effectively is realizable. In

this Embodiment 2 it cannot be overemphasized that the type of the structure of a macro block is mutually convertible for the frame structure and field structure for every MBP. The unit which chooses any of the frame structure and field structure may not be MBP for example is good also considering a macro block as a unit.

[0113]

In the gestalt explained in this embodiment using drawing 9 and drawing 16 After asking for the number or the context of a significant coefficient of a block located in the left-hand side of coding or a decryption object block explained the case where it asked for the number or the context of a significant coefficient of a block located in the coding or decryption object block upper part but. These order may be reverse and influence does not do to the decision results of S1603 in S903 in drawing 9 and drawing 16.

[0114]

Furthermore the system using the application of the variable-length-coding method or a variable length decoding method and it which showed by the above-mentioned embodiment is explained here.

Drawing 20 is a block diagram showing the entire configuration of contents distribution system ex100 which realizes a contents distribution service. It divides into the size of a request of the offer area of communications service and the base stations ex107-ex110 which are fixed-wireless-access offices respectively are installed in each cell.

[0115]

This contents distribution system ex100 for example via Internet Service Provider ex102 telephone network ex104 and the base stations ex107-ex110 to Internet ex101 Each apparatus such as computer ex111 PDA (personal digital assistant) ex112 camera ex113 cellular-phone ex114 and cellular-phone ex115 with a camera is connected.

[0116]

However contents distribution system ex100 is not limited to combination like drawing 20 but it may be made to connect it combining either. Direct continuation of each apparatus may be carried out to telephone network ex104 without passing the base stations ex107-ex110 which are fixed-wireless-access offices.

[0117]

Camera ex113 is apparatus in which animation photography of a digital camcorder etc. is possible. A cellular phone A PDC (Personal Digital Communications) method A CDMA (Code Division Multiple Access) method A W-CDMA (Wideband-Code Division Multiple Access) method Or it may be a portable telephone of a GSM (Global System for Mobile Communications) method or PHS (Personal Handyphone System) and any may be sufficient.

[0118]

Streaming server ex103 is connected through camera ex113 to base station ex109 and telephone network ex104 and the live distribution based on the data which a user transmits using camera ex113 and by which coding processing was carried out etc. become possible. Even if it performs coding processing of the photoed data by camera ex113 it may carry out by the server etc. which carry out transmitting processing of data. The video data photoed with the camera ex116 may be transmitted to streaming server ex103 via computer ex111. Camera ex116 is apparatus which can photo still pictures such as a digital camera and an animation. In this case coding of a video data may be performed by camera ex116 it may carry out by computer ex111 or whichever may be sufficient. Coding processing will be processed in LSI ex117 which computer ex111 and camera ex116 have. The software for image coding and decryption may also be built into some storage media (CD-ROM, a flexible disk, a hard disk etc.) which are the recording media [in computer ex111 grade] which can be read. A video data may be transmitted by cellular-phone ex115 with a camera. The video data at this time is the data by which coding processing was carried out by LSI which cellular-phone ex115 has.

[0119]

In this contents distribution system ex100. While a user does coding processing of the contents (for example image etc. which photoed the music live) currently photoed in camera ex113 and camera ex116 grade like the above-mentioned embodiment and transmits to streaming server ex103 Streaming server ex103 carries out stream distribution of the above-mentioned contents data to a client with a demand. There are computer ex111 which can decrypt as a client the data by which coding processing was carried out [above-mentioned] PDA ex112 camera ex113 and cellular-phone ex114 grade. Contents distribution system ex100 is a system which becomes realizable [individual broadcast] in doing in this way by being able to receive the coded data in a client being able to reproduce receiving in real time in a client decrypting further and reproducing.

[0120]

What is necessary is just to use the variable length coding device or variable length decoding device shown by each above-mentioned embodiment for coding of each apparatus which constitutes this system and decryption.

A cellular phone is explained as the example.

Drawing 21 is a figure showing cellular-phone ex115 using the variable-length-coding method and variable length decoding method which were explained by the above-mentioned embodiment. The image of antenna ex201 for cellular-phone ex115 to transmit and receive an electric wave between base station ex110a CCD camera etc. The image photoed by camera part ex203 which can photograph a still

picture and camera part ex203 Indicator ex202 such as a liquid crystal display which displays the data in which the image etc. which were received by antenna ex201 were decrypted the body part which comprises operation key ex204 group The data of voice input part ex205 such as a microphone for carrying out voice output part ex208 such as a loudspeaker for carrying out voice response and voice input the photoed animation or a still picture It has slot part ex206 for enabling wearing of archive-medium ex207 archive-medium ex207 for saving the coded data of the data of the received mail the data of an animation or the data of a still picture or the decrypted data and cellular-phone ex115. EEPROM (Electrically Erasable and Programmable Read.) which is the nonvolatile memory which can be rewritten and eliminated electrically [archive-medium ex207] in the plastic case of an SD card etc. The flash memory element which is a kind of Only Memory is stored.

[0121]

Cellular-phone ex115 is explained using drawing 22. As opposed to main control part ex311 made as [control / each part of the body part provided with indicator ex202 and operation key ex204 / cellular-phone ex115 / in generalization] Power circuit part ex310 operational input control-section ex304 image encoding part ex312 camera interface part ex303 LCD (Liquid Crystal Display) control-section ex302 image decoding part ex309 demultiplexing part ex308 Recording reproduction section ex307 modulation and demodulation circuit unit ex306 and voice processing part ex305 are mutually connected via synchronous bus ex313.

[0122]

Power circuit part ex310 will start digital portable telephone ex115 with a camera in the state where it can operate by supplying electric power from a battery pack to each part if clear back and a power key are made an ON state by a user's operation.

[0123]

Based on control of main control part ex311 which becomes by CPU ROM RAM etc. cellular-phone ex115 The audio signal which collected the sound by voice input part ex205 at the time of voice call mode is changed into digital sound data by voice processing part ex305 Spectrum diffusion treatment of this is carried out by modulation and demodulation circuit unit ex306 and after performing digital-to-analog-conversion processing and frequency conversion processing by transmitting and receiving circuit section ex301 it transmits via antenna ex201. Portable telephone ex115 amplifies the input signal received by antenna ex201 at the time of voice call mode and performs frequency conversion processing and analog-to-digital-conversion processing After carrying out spectrum back-diffusion-of-gas processing by modulation and demodulation circuit unit ex306 and changing into an analog voice signal by voice

processing part ex305 this is outputted via voice output part ex208.

[0124]

When transmitting an E-mail at the time of data communication mode the text data of the E-mail inputted by operation of operation key ex204 of a body part is sent out to main control part ex311 via operational input control-section ex304. Main control part ex311 carries out spectrum diffusion treatment of the text data by modulation and demodulation circuit unit ex306 and after it performs digital-to-analog-conversion processing and frequency conversion processing by transmitting and receiving circuit section ex301 it transmits to base station ex110 via antenna ex201.

[0125]

When transmitting image data at the time of data communication mode the image data picturized by camera part ex203 is supplied to image encoding part ex312 via camera interface part ex303. When not transmitting image data it is also possible to display directly the image data picturized by camera part ex203 on indicator ex202 via camera interface part ex303 and LCD control-section ex302.

[0126]

Image encoding part ex312 is the composition provided with the image encoding apparatus explained by the invention in this application. By carrying out compression encoding of the image data supplied from camera part ex203 with the encoding method used for the image encoding apparatus shown by the above-mentioned embodiment it changes into coded image data and this is sent out to demultiplexing part ex308. Portable telephone ex115 sends out simultaneously the sound which collected the sound by voice input part ex205 as digital voice data via voice processing part ex305 demultiplexing part ex308 during an image pick-up by camera part ex203 at this time.

[0127]

Demultiplexing part ex308 multiplexes the coded image data supplied from image encoding part ex312 and the voice data supplied from voice processing part ex305 by a prescribed method. Spectrum diffusion treatment of the multiplexing data obtained as a result is carried out by modulation and demodulation circuit unit ex306 and after performing digital-to-analog-conversion processing and frequency conversion processing by transmitting and receiving circuit section ex301 it transmits via antenna ex201.

[0128]

When the data of the video file linked to the homepage etc. at the time of data communication mode is received spectrum back-diffusion-of-gas processing of the input signal received from base station ex110 via antenna ex201 is carried out by modulation and demodulation circuit unit ex306 and the multiplexing data obtained as a result is sent out to demultiplexing part ex308.

[0129]

In order to decrypt the multiplexing data received via antenna ex201Demultiplexing part ex308 is divided into the encoded bit streams of image dataand the encoded bit streams of voice data by separating multiplexing dataThe coded image data concerned is supplied to image decoding part ex309 via synchronous bus ex313and the voice data concerned is supplied to voice processing part ex305.

[0130]

Nextimage decoding part ex309 is the composition provided with the image decoding device explained by the invention in this applicationReproduction dynamic image data is generated by decoding the encoded bit streams of image data with the decoding method corresponding to the encoding method shown by the above-mentioned embodimentThis is supplied to indicator ex202 via LCD control-section ex302and the video data contained in the video file linkedfor example to the homepage by this is displayed. At this timesimultaneouslyafter voice processing part ex305 changes voice data into an analog voice signalthis is supplied to voice output part ex208andthereby***** voice data is reproduced by the video file linkedfor example to the homepage.

[0131]

It is not restricted to the example of the above-mentioned systembut a satellite and digital broadcasting by a terrestrial wave have become the center of attention recentlyand as shown in drawing 23even if the system for digital broadcasting also has few above-mentioned embodimentseither an image encoding apparatus or an image decoding device is incorporable. Specifically by broadcasting station ex409the encoded bit streams of video information are transmitted to communication or broadcasting satellite ex410 via an electric wave. Broadcasting satellite ex410 which received this sends the electric wave for broadcastand this electric wave is received by antenna ex406 of a home with satellite reception equipmentEncoded bit streams are decrypted with devicesuch as television (receiver) ex401 or set top box (STB) ex407and this is reproduced. It is possible to read the encoded bit streams recorded on storage-medium ex402 which is a recording mediumsuch as CD and DVDand to mount the image decoding device shown by the above-mentioned embodiment also in playback equipment ex403 to decrypt. In this casethe reproduced video signal is displayed on monitor ex404. An image decoding device is mounted in the set top box ex407 connected to cable ex405 for cable TVor antenna ex406 of a satellite/terrestrial broadcastingand the composition which reproduces this by monitor ex408 of television is also considered. At this timean image decoding device may also be incorporated not in a set top box but in television. It is also possible to reproduce an animation to the display of the car navigation ex413 grade which receives base station ex107 grade to a signal from satellite

ex410 by vehicle ex412 which has antenna ex411 and vehicle ex412 has.

[0132]

A picture signal can be coded with the image encoding apparatus shown by the above-mentioned embodiment and it can also record on a recording medium. As an example there is recorder ex420 such as a DVD recorder which records a picture signal on DVD disk ex421 and a disk recorder recorded on a hard disk. It is also recordable on SD card ex422. If recorder ex420 is provided with the image decoding device shown by the above-mentioned embodiment the picture signal recorded on DVD disk ex421 or SD card ex422 can be played and it can display by monitor ex408.

[0133]

The composition of car navigation ex413 For example the inside of composition of being shown in drawing 22 The composition except camera part ex203 camera interface part ex303 and image encoding part ex312 can be considered and the same thing is considered also in computer ex111 or television (receiver) ex401 grade.

[0134]

The terminal of the above-mentioned cellular-phone ex114 grade can consider three kinds of mounting forms of the transmit terminal of only coding equipment and the receiving terminal of only a decryption machine other than a transmitting and received type terminal with both coding equipment and a decryption machine.

[0135]

Thus it is possible to use for the apparatus system of the gap which wants to mention above the variable-length-coding method or variable length decoding method shown by the above-mentioned embodiment and the effect explained by the above-mentioned embodiment can be acquired by doing so.

[0136]

[Effect of the Invention]

As mentioned above the variable-length-coding method of this invention and a variable length decoding method When coding the number of the significant coefficient of each block with a CAVLC method and the size of a coding target block differs from the size of peripheral blocks The number of the significant coefficient of peripheral blocks is changed based on the ratio of the size of a coding target block and peripheral blocks and this changed value is used for the determination of a variable-length-coding table.

[0137]

By the above operation even if it is a case where the size of a coding target block differs from the size of peripheral blocks the variable-length table according to the size of the coding target block can be determined and improvement in encoding efficiency can be aimed at.

[0138]

When each block codes the bit (CBP bit) which shows whether it has a significant coefficient with a CABAC methodthe variable-length-coding method of this invention The size of a coding target blockWhen the sizes of peripheral blocks differthe existence of the significant coefficient of peripheral blocks is changed based on the ratio of the size of a coding target block and peripheral blocksand this changed value is used for the determination of the probability table used in a CABAC method.

[0139]

By the above operationseven if it is a case where the size of a coding target block differs from the size of peripheral blocksthe probability table according to the size of the coding target block can be determinedand improvement in encoding efficiency can be aimed at.

[0140]

When the bit which shows whether each coefficient within a block is a significant coefficient with a CABAC method carries out the encoding method of the variable-length-coding method of this inventionit prepares a probability table according to the size of a coding target blockand prepares the probability table of a different group for every block size. Or a probability table is prepared according to the maximum block size of a coding target blockand it is not concerned with the difference in the size of a blockbut the group of the same probability table is used.

[0141]

By the above operationseven if it is a case where a block has two or more sizesimprovement in encoding efficiency can be aimed at by having a group of a probability table for each size of a block. By preparing a probability table according to the maximum of the size of a blockand not being concerned with the difference in the size of a blockbut using the group of the same probability tablethe number of probability tables can be reduced and memory size can be made small.

[0142]

When a picture signal is an interlace and a CAVLC method and a CABAC method are used for this invention as variable length coding and a decoding methodBased on coincidence and a difference of coding structure of whether an object block and peripheral blocks are coded by the frame structureor to be coded by field structurethe variable-length-coding table and the probability table are determined. Even if it is a case where the block of the frame structure and field structure is intermingleda VLC table and a probability table are uniquely determined by thisand encoding efficiency improves by it.

[Brief Description of the Drawings]

[Drawing 1]The block diagram for describing an embodiment of the invention

[Drawing 2]The mimetic diagram for describing an embodiment of the invention

[Drawing 3]The block diagram for describing an embodiment of the invention

[Drawing 4]The mimetic diagram for explaining an embodiment of the invention and a conventional example

[Drawing 5]The mimetic diagram for explaining a conventional example

[Drawing 6]The mimetic diagram for explaining a conventional example

[Drawing 7]The functional block diagram showing the composition of the video coding equipment concerning this Embodiment 2

[Drawing 8]The explanatory view showing the relation between the data structure of MBP coded by the frame structure concerning Embodiment 2 and the data structure of MBP coded by field structure

[Drawing 9]The flow chart which shows the big flow of the computational procedure in the case of the CAVLC method concerning Embodiment 2 determining a context and determining a corresponding VLC table

[Drawing 10]The table which illustrates the relation of the number of a significant coefficient and the VLC table concerning Embodiment 2

[Drawing 11]The flow chart which shows the details of the computational procedure (two kinds (a) and (b)) which calculates number NL of the significant coefficient of peripheral-blocks A concerning Embodiment 2

[Drawing 12]The figure showing an example of arrangement of peripheral-blocks A in case coding target block C concerning Embodiment 2 is field structure and the frame structure and A'

[Drawing 13]The flow chart explaining the details of the computational procedure (two kinds (a) and (b)) which asks for the number NU of the significant coefficient of peripheral-blocks B using the CAVLC method concerning Embodiment 2

[Drawing 14]The figure showing an example of arrangement of peripheral-blocks B in case coding target block C concerning Embodiment 2 is field structure and the frame structure and B'

[Drawing 15]The flow chart which shows the details of the decision procedure (two kinds (a) and (b)) of the VLC table concerning this Embodiment 2

[Drawing 16]The flow chart which shows the big flow of the computational procedure in the case of the CABAC method concerning Embodiment 2 determining a context and determining a corresponding probability table

[Drawing 17]The flow chart which shows the details of the computational procedure (two kinds (a) and (b)) which calculates the context value ctxA of peripheral-blocks A using the CABAC method concerning Embodiment 2

[Drawing 18]The flow chart which shows the details of the computational procedure (two kinds (a) and (b)) which calculates the context value of peripheral-blocks B using the CABAC method concerning Embodiment 2

[Drawing 19]The flow chart which shows the details of the decision procedure

of the probability table concerning this Embodiment 2

[Drawing 20]The block diagram showing the entire configuration of a contents distribution system

[Drawing 21]The example of the cellular phone using a video encoding method and a video decoding method

[Drawing 22]The block diagram of a cellular phone

[Drawing 23]The example of the system for digital broadcasting

[Drawing 24]The reference drawing showing the method of calculation of the conventional probability table

[Description of Notations]

101 and 107 Frame memory

102 Difference operation part

103 Prediction error coding part

104 Code string generation part

105 Prediction error decoding section

106 Add operation part

108 Motion vector primary detecting element

109 Mode selection part

701 Block counter

MBP Macro block pair

DESCRIPTION OF DRAWINGS

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[Drawing 18]The flow chart which shows the details of the computational procedure (two kinds(a) and (b)) which calculates the context value of peripheral-blocks B using the CABAC method concerning Embodiment 2

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